

WHAT IS CLAIMED IS:

1. An optical disc including a substrate on which pits having at least two different depths are formed, wherein

5 a first pit and a second pit are formed such that depth D1 of said first pit and depth D2 of said second pit satisfy the relation of  $0 < D1 < \lambda / 4n$  and  $\lambda / 4n < D2 < \lambda / 2n$ , where D1 represents the depth of the first pit, D2 represents the depth of the second pit,  $\lambda$  represents wavelength of light beam used for reproducing said optical disc, and n represents an index of refraction of the substrate of said optical disc.

2. The optical disc according to claim 1, wherein said first pit and said second pit are formed to satisfy the relation of  $\lambda / 8n < D1 < \lambda / 4n$  and  $\lambda / 4n < D2 < 3 \lambda / 8n$ .

5 3. An optical disc including a substrate having pits of at least two different depths formed therein, wherein a first pit and a second pit are formed such that depth D1 of said first pit and depth D2 of said second pit satisfy the relation of  $(k \lambda / 2n) < D1 < \{ (\lambda / 4n) + (k \lambda / 2n) \}$  and  $\{ (\lambda / 4n) + (m \lambda / 2n) \} < D2 < \{ (m + 1) \cdot \lambda / 2n \}$ , where D1 represents the depth of the first pit, D2 represents the depth of the second pit,  $\lambda$  represents wavelength of light beam used for reproducing said optical disc, n represents an index of refraction of the substrate of said optical disc, and k and m represent arbitrary integers.

4. The optical disc according to claim 3, wherein at least one of said integers k and m is 0.

5 5. An optical disc including a substrate having pits having at least two different depths formed therein, wherein

the pits have their depths adjusted such that polarity of a signal representing difference in intensity distribution of a reflected light beam along a tangential direction of a pit string differ at a pit having a first depth

from a pit having a second depth.

6. An optical disc including a substrate having pits having at least two different depths formed therein, wherein

5 information is recorded in accordance with a polarity of a signal representing difference in intensity distribution of a reflected light beam along a tangential direction of a pit string, at said pits having at least two different depths.

7. An optical disc including a substrate having pits having at least two different depths formed therein, wherein

5 information is recorded by a combination of a signal in accordance with quantity of reflected light beam from said pits having at least two different depths and a signal indicative of a difference in intensity distribution of the reflected light beam along a tangential direction of a pit string.

8. An optical disc including a substrate having pits having at least two different depths formed therein, wherein

main information is recorded by a form of the pits, and additional information is recorded by the depth of the pit.

9. The optical disc according to claim 8, wherein the pit having said additional information is formed deeper than a prescribed depth.

10. The optical disc according to claim 8, wherein

said additional information is a synchronizing signal for reproducing said optical disc.

11. The optical disc according to claim 8, wherein said additional information is address information corresponding to said main information.

12. The optical disc according to claim 8, wherein said additional

information is a de-scramble key of said main information.

13. The optical disc according to claim 8, wherein said additional information is error correction information for said main information.

14. The optical disc according to claim 8, wherein unit of recording of said additional information is recorded in association with a unit of recording of said main information.

15. An optical disc reproducing device, comprising:  
a first detecting unit detecting a first signal in accordance with a quantity of reflected light beam from an optical disc;  
a second detecting unit detecting a second signal representing a difference in intensity distribution of the reflected light beam along a tangential direction of a pit string of said optical disc; and  
a reproducing unit reproducing information recorded on said optical disc based on the first signal detected by said first detecting unit and the second signal detected by said second detecting unit.

16. The optical disc reproducing device according to claim 15, wherein said reproducing unit reproduces information recorded on said optical disc based on polarity of the second signal detected by said second detecting unit.

17. The optical disc reproducing device according to claim 16, wherein said reproducing unit reproduces three-valued information recorded on said optical disc.

18. The optical disc reproducing device according to claim 15, wherein

said reproducing unit includes a first comparing circuit comparing the second signal detected by said second detecting unit with first reference value and outputting a positive signal when voltage of said second signal is

not lower than said first reference value,

a second comparing circuit comparing the second signal detected by said second detecting unit with a second reference value, and outputting a negative signal when voltage of said second signal is not higher than said second reference value, and

an additional circuit adding the positive signal output from said first comparing circuit and the negative signal output from said second comparing circuit.

19. The optical disc reproducing device according to claim 15, wherein

said reproducing unit includes a first comparing circuit comparing the second signal detected by said second detecting unit with a first reference value,

a second comparing circuit comparing the second signal detected by said second detecting unit with a second reference value, and

a latch circuit holding a result of comparison by said first comparing circuit and a result of comparison by said second comparing circuit, at a point of transition of the first signal output from said first detecting unit.

20. An optical disc reproducing device, comprising:

a main information reproducing unit reproducing main information by a reflected light beam from a pit formed on a substrate of the optical disc; and

an additional information reproducing unit reproducing additional information by detecting a depth of said pit.

21. The optical disc reproducing device according to claim 20, further comprising a controller limiting reproduction of the main information by said main information reproducing unit when said additional information reproducing unit is unable to reproduce said additional information.

22. The optical disc reproducing device according to claim 20,  
further comprising:  
a display unit displaying, when said additional information  
reproducing unit is unable to reproduce said additional information, the fact  
5 that the additional information cannot be reproduced.

23. The optical disc reproducing device according to claim 20,  
further comprising:  
a servo control unit outputting a tracking servo signal; and  
a controller outputting the tracking servo signal output from said  
5 servo control unit when said additional information reproducing unit is  
unable to reproduce said additional information.

24. The optical disc reproducing device according to claim 20,  
further comprising:  
a servo control unit outputting a tracking servo signal; and  
a controller inverting polarity of the tracking servo signal output  
5 from said servo control unit when said additional information reproducing  
unit is unable to reproduce said additional information.

25. The optical disc reproducing device according to claim 20,  
further comprising:  
a counter counting number of said additional information; and  
a controller controlling reproduction of the additional information by  
5 said additional information reproducing unit based on the value of said  
counter.

26. The optical disc reproducing device according to claim 20,  
comprising a controller controlling said additional information reproducing  
unit so that the additional information is reproduced, when contents of the  
main information cannot be reproduced by said main information  
5 reproducing unit.

27. The optical disc reproducing device according to claim 20, further comprising a controller controlling said additional information reproducing unit such that the additional information is reproduced in synchronization with reproduction of the main information by said main information reproducing unit.

28. The optical disc reproducing unit according to claim 20, further comprising a controller limiting reproduction of the main information by said main information reproducing unit when said additional information cannot be reproduced by said additional information reproducing unit.

29. A method of reproduction, comprising the steps of:  
detecting a first signal based on a quantity of light beam reflected from an optical disc;  
detecting a second signal indicative of a difference in intensity distribution of the reflected light beam along a tangential direction of a pit string on said optical disc;  
reproducing the main information recorded on said optical disc based on said detected first signal; and  
reproducing additional information recorded on said optical disc based on said detected second signal.

30. The method of reproduction according to claim 29, wherein said step of reproducing additional information recorded on said optical disc includes the step of reproducing the additional information recorded on said optical disc based on polarity of said second signal.

31. The method of reproduction according to claim 30, wherein said step of reproducing additional information recorded on said optical disc includes the step of reproducing three-valued information recorded on said optical disc.

32. The method of reproduction according to claim 29, wherein

said step of reproducing the additional information recorded on said optical disc includes the step of comparing said second signal with a first reference value and outputting a positive signal when voltage of said second  
5 signal is not lower than said first reference value,

the step of comparing said second signal with a second reference value and outputting a negative signal when voltage of said second signal is not higher than said second reference value, and

adding said output positive signal and the negative signal.

33. The method of reproduction according to claim 29, wherein said step of reproducing additional information recorded on said optical disc includes the steps of:

5 comparing said second signal with a first reference value,  
comparing said second signal with a second reference value, and  
holding the result of comparison of said second signal with said first reference value and the result of comparison of said second signal with said second reference value, at a point of transition of said first signal.

34. An optical disc reproducing device reproducing an optical disc having pits of at least two different depths formed therein, comprising:

a photoreceptor element detecting a light beam reflected from said optical disc;

5 a pit depth detecting unit detecting depth of the pit formed on said optical disc based on the quantity of the reflected light beam detected by said photoreceptor element;

10 a servo signal generating unit generating a tracking servo signal based on the quantity of the reflected light beam detected by said photoreceptor element; and

a polarity inverting unit inverting polarity of the tracking servo signal generated by said servo signal generating unit based on the result of detection by said pit depth detecting unit.

35. The optical disc reproducing device according to claim 34,

wherein said pit depth detecting unit detects depth of the pit formed in said optical disc based on a signal indicative of a difference in intensity distribution of the reflected light beam along a tangential direction of a pit string on said optical disc.

36. The optical disc reproducing device according to claim 34, wherein said pit depth detecting unit includes a first detecting unit detecting a first signal based on the quantity of reflected light beam from said optical disc,

a second detecting unit detecting a second signal indicative of the difference in intensity distribution of the reflected light beam along the tangential direction of the pit string on said optical disc, and

a third detecting unit detecting the depth of the pit formed in said optical disc based on the first signal detected by said first detecting unit and the second signal detected by said second detecting unit.

37. The optical disc reproducing device according to claim 36, wherein

said third detecting unit includes a first comparing circuit comparing the second signal detected by said second detecting unit with a first reference value,

a second comparing circuit comparing the second signal detected by said second detecting unit with a second reference value, and

a flip-flop circuit holding the result of comparison by said first comparing circuit and the result of comparison by said second comparing circuit, at a point of transition of the first signal output from said first detecting unit.

38. The optical disc reproducing device according to claim 34, wherein

said servo signal generating unit generates the tracking servo signal by detecting phase difference of the quantity of reflected light beam detected by said photoreceptor element.



39. The optical disc reproducing device according to claim 34,  
wherein

5       said servo signal generating unit generates the tracking servo signal  
by detecting difference in intensity of the reflected light beam on an inner  
peripheral side and on an outer peripheral side of the optical disc detected  
by said photoreceptor element.

40. The optical disc reproducing device according to claim 34,  
wherein said photoreceptor element is divided into four along a tangential  
direction of the pit string and along the radial direction of said optical disc.

41. The optical disc reproducing device according to claim 34,  
wherein

5       said photoreceptor element includes a first element and a second  
element divided along the radial direction of said optical disc,

      said first element includes a third element and a fourth element  
divided along the radial direction of said optical disc, and

      said second element includes a fifth element and a sixth element  
divided along the tangential direction of the pit string.